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ABSTRACT

Performance objectives are stated for each of the secondary school units included in this package of instructional guides prepared for the Dade County Florida Quinmester Program. All three units are concerned with chemistry: "Applied Chemistry 1," "Chemistry of Biology," and "Matter and Its Changes." The last unit deals with chemistry at a very introductory level. Lists of texts, films, filmstrips, and other instructional aids are included in each unit. A course outline summarizing the content of the units, numerous suggestions for experiments, activities, and projects are given. A master sheet showing the relationship of each suggested activity to the objectives of the package is appended to each booklet. (TS)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DADE COUNTY PUBLIC SCHOOLS

Science: APPLIED CHEMISTRY 1 [LIVING WITH CHEMISTRY] 5316.03

DIVISION OF INSTRUCTION • 1971

APPLIED CHEMISTRY I (LIVING WITH CHEMISTRY)

5316.03

SCIENCE

(Experimental)

Written By R. Schmidt and T. Spencer
for the
DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Fla.
1971

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APPLIED CHEMISTRY I

COURSE DESCRIPTION:

Through experimental study of the common elements, compounds, and mixtures in his surroundings, the student will be introduced to a practical knowledge of chemistry. Laboratory investigations and teacher demonstrations based on the use of materials found in his environment should (1) increase his awareness of and appreciation for the chemical aspects of the world around him and (2) develop skills and attitudes which will enable him to use materials in his surroundings to better advantage.

ENROLLMENT GUIDELINES

For the student who has an interest in the practical applications of chemistry.

STATE ADOPTED TEXTS

Metcalfe. Modern Chemistry.
New York: Holt, Rinehart and Winston, Inc., 1966

Choppin. Chemistry: Science of Matter, Energy, Change.
Morristown, N. J.: Silver Burdett Co., 1965

Greenstone, Concepts in Chemistry
New York: Harcourt, Brace & World Inc., 1966

O'Connor, Chemistry: Experiments and Principles
Lexington, Ma.: Raytheon Education Co., 1968

Oxenhorn, Pathways in Science, Chemistry 1
New York: Globe Book Co., 1968

Oxenhorn, Pathways in Science, Chemistry 2
New York: Globe Book Co., 1969

Oxenhorn, Pathways in Science, Chemistry 3
New York: Globe Book Co., 1970

PERFORMANCE OBJECTIVES

The student will:

1. use available laboratory equipment according to specifications.
2. identify selected laboratory apparatus by its common name.
3. calculate Metric and English equivalents in common use.
4. manipulate laboratory equipment to achieve satisfactory solution, filtration, distillation, and chromatography.
5. identify metals and nonmetals on a periodic chart.
6. identify the ordinary state of common elements by using a periodic chart.
7. discriminate among elements, compounds and mixtures.
8. select examples of synthesis and analysis.
9. write balanced equations for simple reactions.
10. differentiate between inorganic and organic compounds.
11. differentiate among different oxidation states of nitrogen.
12. identify formulas for acids, bases and salts.
13. prepare an acid, a base and a salt in the laboratory.
14. identify an unknown substance as an acid or a base using two indicators.
15. identify the chemical action of ingredients in selected household products.
16. discriminate between beneficial and detrimental uses of prescription drugs and nonprescription drugs.
17. compare halogens with their household and industrial uses.
18. classify organic formulas into correct nomenclature groups.
19. synthesize a hydrocarbon, an ester, and a soap in the laboratory.
20. prepare a face cream in the laboratory.
21. identify a natural or synthetic compound by flavor or odor.

COURSE OUTLINE

I. Lab Equipment and Orientation

A. Safety

B. Nomenclature and usage

1. Solutions

2. Filtration

3. Distillation

4. Chromatography

C. Metric system

II. Chemical Families

A. Periodic Chart

1. Metals and Non-metals

2. Oxidation Numbers

B. Elements and Compounds

C. Analysis

1. Electrolysis of water

2. Thermal decomposition

D. Synthesis

1. Iron and sulfur

2. Water

E. States of matter

III. Formula and Equation Writing

A. Common elements

B. Common compounds

C. Writing and balancing equations

IV. Carbon and its Compounds

A. Carbon dioxide and monoxide

1. Combustion

2. Fermentation

B. Inorganic carbonates and bicarbonates

1. Sodium salts

2. Calcium salts

C. Organic Compounds

1. Acetylene

2. Propane

3. Paraffin

4. Benzene and Toluene

V. Nitrogen and its Compounds

A. Determination in atmosphere

B. Inorganic ammonia, nitrate and nitrite

C. Organic amines and amino acids

VI. Acids, Bases and Salts

A. Properties

B. Nomenclature

C. Preparation

D. Indicators

E. Crystals

VII. Household Chemicals

A. Safety

B. Nomenclature

1. Cleaning agents and bleaches

2. Solvents

3. Oil base and water base paints

C. Drug use and abuse

VIII. Halogens

A. Chlorine

1. Bleaches and water purification

2. Acids and salts

3. Corrosion

4. Medicines

B. Bromine

1. Fuel additive

2. Water purification

3. Medicines

C. Iodine

1. Antiseptics and radiopaque agents

2. Water purification

3. Photography

D. Fluorine

1. Dentistry and water treatment

2. Aluminum production

3. Rocket fuels

IX. Organic Chemistry

A. Nomenclature

1. Hydrocarbon

2. Ester

3. Fat

4. Carbohydrate

5. Protein

B. Applications

1. Perfumes and flavors

2. Soaps and detergents

3. Cosmetics

4. Fuels

5. Beverages

6. Pharmaceuticals

EXPERIMENTS

Eckert, Discovery Problems in Chemistry.
New York: College Entrance Book Company. 1969.

1. Laboratory Techniques: (The Bunsen Burner, p. 3)
2. Laboratory Techniques: (Manipulating Tubing, p. 5)
3. Laboratory Techniques: (Reagents, p. 7)
4. Laboratory Techniques: (Weighing-Measuring, p. 9)
5. Laboratory Techniques: (Alternative, p. 11)
6. Physical and Chemical Changes (Ex. 1, p. 15)
7. Carbon Dioxide (Ex. 6-3, p. 229)
8. Oxygen (Ex. 3-1, p. 73)
9. Hydrogen (Ex. 3-3, p. 81)
10. Destructive Distillation (Ex. 9-2, p. 313)
11. Hydrocarbons (Ex. 9-3, p. 315)
12. Composition of Air (Ex. 7-5, p. 263)
13. Ammonia and Ammonium Compounds (Ex. 7-6, p. 267)
14. Sulfur Dioxide (Ex. 7-3, p. 257)
15. Formation of Salts (Ex. 6-1, p. 217)
16. Properties of Acids and Bases (Ex. 5-4, p. 175)
17. Preparation of Soap (Ex. 9-6, p. 327)
18. Carbohydrates (Ex. 9-7, p. 331)
19. Proteins and Fats (Ex. 9-8, p. 333)
20. Organic Acids, Alcohols, and Esters (Ex. 9-5, p. 325)

Brooks, W. O.; Tracy, G. R.; and Tropp, H. E. Modern Physical Science.
New York: Holt, Rinehart and Winston, Inc. 1962.

22. The Metric System (Ex. 1, p. 93)
23. Mixtures and Compounds (Ex. 3, p. 97)
24. How to Prepare Oxygen (Ex. 5, p. 101)
25. Mixing Acids and Bases (Ex. 10, p. 111)
26. What Are Acids Like (Ex. 8, p. 107)
27. How Do Bases Act (Ex. 9, p. 109)
28. How to Make Soap (Ex. 121, p. 121)
29. Making Baking Powder (Ex. 16, p. 123)
30. Making Cold Cream (Ex. 17, p. 125)
31. Solutions and Getting Crystals (Ex. 12, p. 115)
32. Natural Fibers (Ex. 20, p. 131)
33. Chemistry of Photography (Ex. 13, p. 117)
34. Making Paint (Ex. 19, p. 129)

DEMONSTRATIONS

Oxenhorn, Pathways in Science, Chemistry 1.
New York: Globe Book Company, 1968.

1. Compounds and Mixtures (Fig. 62-1, 2)
2. Starving a Candle (Fig. 90-1)
3. How to Make Ammonia (Fig. 112-2)
4. Electrolysis of Water (Fig. 39-1)
5. Making Pure Oxygen (Fig. 39-1)
6. Preparing Carbon Dioxide (Fig. 98-1)
7. Making Pure Oxygen (Fig. 120-1)
8. Separating Sand and Salt (Fig. 12301)
9. The Flame Test (Fig. 129-1)

Oxenhorn, Pathways in Science, Chemistry 2.
New York: Globe Book Company, 1969.

10. Hydrogen From Acids (Fig. 100-1)
11. Indicator Changes of Bases (p. 104)
12. Cleaning Water (Fig. 82-1)
13. Copper Plating (Fig. 116-1)
14. Filtration (Fig. 31-1)
15. Distillation (Fig. 34-1)
16. Mayonnaise for Salads (Fig. 69-1)
17. Making Soap (p. 86)
18. Neutralization (p. 108)

Oxenhorn, Pathways in Science, Chemistry 3.
New York: Globe Book Company, 1970.

19. Flame Tests (Fig. 31-1)
20. Similarity of Sodium and Potassium (p. 36)
21. When Metals Combine with Nonmetals (Fig. 51-1)

Eckert, Discovery Porblems in Chemistry.
New York: College Entrance Book Company, 1969.

22. Preparation of Chlorine (Ex. 6-4, p. 235)
23. Preparation of Nitric Acid (Ex. 7-7, p. 271)

ADDITIONAL IDEAS FOR DEMONSTRATIONS

24. Display of Common Elements and Compounds
25. Fire Fighting with Soda-acid, Dry Chemical, and CO_2 Extinguishers
26. Flammability of Solvent Vapors in Tilted Metal Trough
27. Calcium Carbide Cannon
28. Prescription Drug Display
29. Essential Oils Used in Flavors and Perfumes
30. Insect Killing Bottle for Solvent Toxicity Demonstration
31. Controlled Mixing of Bleach and Ammonium Hydroxide
32. Paper, Column, and Thin Layer Chromatography
33. Smoking and Nonsmoking Fuels

PROJECTS

1. Crystal Growing
2. Fire Safety
3. Investigating Fuels
4. Preserving Foods
5. Hydroponic Farming
6. Extracting Natural Indicators
7. Household Chemicals
8. Drug Use and Abuse
9. Extracting Natural Flavors and Perfumes
10. Effects of Detergents
11. Antiseptics and Disinfectants
12. Making a Simple Battery
13. Photography
14. Preventing Corrosion
15. Paper Chromatography
16. Phosphorescence and Fluorescence
17. "Working Models" of Atoms
18. Fresh Water from Salt Water

REPORTS

1. Local Water Purification
2. Benefit and Cost of Metric System Conversion
3. Corrosion of Metals
4. Uses of Organic Compounds
5. Industrial Uses of Sulfuric Acid
6. Etching of Glass
7. Manufacturing of Glass
8. Dangers of Household Chemicals
9. Organic Solvents in the Household
10. Use and Abuse of Prescription Drugs
11. Economics of Cosmetic Use
12. Fertilizers and Their Uses
13. Eutrophication
14. Oxides of Nitrogen
15. How Antiseptics Work
16. Nitrogen Fixation
17. Hard Water and Water Softeners
18. Nitrogen cycle
19. Electroplating
20. Dry and Wet Cell Batteries
21. Fermentation
22. Population Control through Chemistry

FIELD TRIPS

1. Local city water purification plant
2. Local commercial dry cleaning plant
3. Local milk Pasteurization plant
4. Local city sewage plant
5. Biscayne Chemical Co., Miami
6. F. F. C. Fertilizer Co., Homestead
7. Academy Laboratories, Miami
8. Applied Research Labs of Florida, Hialeah
9. Chemical Research Institute, Miami
10. Erwin Chemical Laboratory, Miami
11. University of Miami, Chemistry Department, Coral Gables

RESOURCE PERSONS TO PROVIDE SPEAKERS

Chemistry

1. Col. R. B. Levin
   Standard Chemical Co.
   P. O. Box 667, North West Station, Hialeah 33147

2. Dr. A. P. Mills
   Department of Chemistry
   University of Miami
   Coral Gables, Florida

Medical

1. Dade County Medical Association
   2 S. E. 13th Street
   Miami, Florida

2. Mrs. Anna Rundell
   American Society of Medical Technologists
   2213 Red Road
   Coral Gables, Florida

3. Dr. Eli Gersten
   South Florida Veterinary Medical Association
   6100 S. Dixie Highway
   Miami, Florida

4. Mr. Ben Saks
   S. E. Florida Pharmaceutical Assoc.
   2337 S. W. 4th Street
   Miami, Florida

Conservation-Pollution

1. Mrs. Flora O'Brien
   Tropical Audubon Society
   4440 W. Flagler, Miami, Florida

2. Mr. Jim Brantly
Game and Fish Commission
551 Military Trail
West Palm Beach, Florida 33404

3. Mrs. Ann Weeks
Tropical Biological Laboratories
75 Virginia Beach Drive
Key Biscayne, Florida

RELATED PROBLEMS

1. Hardness of city water.
2. Cost comparison of soaps and synthetic detergents.
3. Disposal of chemical waste.
4. Pollution: water, air, land, sound, and people.
5. Related Vocational Skills: Chemistry for a more rewarding life work.
6. Chemical energy transformed into electrical energy.
7. New Petrochemicals for the consumer.

FILMS - DADE COUNTY 16MM FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER

1. Elements, Compounds and Mixtures
AV# 1-30227 25 minutes, C

2. Crystals: Their Form and Color
AV# 5-20018, 21 minutes, C

3. Chemical Families
AV# 1-10819, 21 minutes, C

4. Carbon and its Compounds
AV# 1-01968, 10 minutes, BW

5. Combustion
AV# 1-10741, 15 minutes, C

6. Gases and How They Combine
AV# 1-10844, 22 minutes, C

7. Hydrogen
AV# 1-10938, 14 minutes, C

8. Miracle Materials
AV# 1-11614, 23 minutes, BW

9. Nitric Acid
AV# 1-10884, 15 minutes, C

10. Acids, Bases and Salts
AV# 1-10947, 21 minutes, C

11. Catalysis
AV# 1-10809, 16 minutes, C

12. Explaining Matter: Atoms and Molecules
AV# 1-10777, 13 minutes, C

13. The Hydrogen Atom
AV# 1-10854, 22 minutes, C

14. Synthesis of an Organic Compound
AV# 1-10890, 20 minutes, C

15. Using the Laboratory
AV# 1-01342, 11 minutes, C

16. Measurement in Physical Science
AV# 1-10452, 14 minutes, BW

FILM LOOPS-SINGLE CONCEPT

1. Lead-Acid Storage Battery, Ealing, 1967, C
2. Handling Solids and Liquids, Ealing, 1967, C
3. Heating Solids, Ealing, 1967, C
4. Heating Liquids, Ealing, 1967, C
5. Filtration, Ealing, 1967, C
6. Use of Burette, Ealing, 1967, C
7. Use of Pipette, Ealing, 1967, C
8. Working Glass, Ealing, 1967, C
9. Warning Coloration, Ealing, 1967, C
10. The Bunsen Burner, Ealing, 1967, C
11. Measuring Techniques, Ealing, 1967, C
12. Weighing with 2-pan Balance, 1967, C
13. Weighing with Triple Beam Balance, Ealing, 1967
14. Photosynthetic Fixation of CO_2, Ealing, 1967

FILMSTRIPS

1. Acids and Bases, EBF, 1964, C
2. Chemical Formula, McGraw Hill, 1940, BW
3. Chemical Reactions, EBF, 1964, C
4. Atomic and Molecular Weight, EBF, 1960, C
5. Energy of Reactions, EBF, 1964, C
6. Ionic and Covalent Bonds, EBF, 1960, C
7. Introduction to Chemical Laboratory, EBF, 1960
8. The Mole Concept, EBF, 1960
9. Electrolysis, McGraw Hill, 1949, BW
10. Periodic Table, McGraw Hill, 1949, BW
11. Laboratory Techniques, McGraw Hill, 1954, C

12. Crystals, McGraw Hill, 1954, C
13. Water Purification, McGraw Hill, 1954, C
14. Nuclear Energy, McGraw Hill 1954, C
15. Hydrocarbons, McGraw Hill, 1954, C
16. Electroplating, McGraw Hill, 1954, C
17. Balancing Equations, McGraw Hill, 1954, C
18. The Flourine Story, McGraw Hill, 1954, C
19. Atomic Theory, McGraw Hill, 1954, C
20. Equations, McGraw Hill, 1954, BW
21. Ionization, McGraw Hill, 1954, BW
22. Composition of Matter, EBF, 1960, C
23. Composition of Atoms, EBF, 1960, BW

SUGGESTED DISCUSSION QUESTIONS

1. Why should the layman study chemistry?
2. How can the proper use of chemistry give people a better life?
3. How can the improper use of chemicals be a hazard to plant and animal life?
4. What chemical techniques and problems are involved in the desalinization of seawater?
5. How can the oceans become an even more important source of chemicals than they are at present?
6. What is the cumulative effect of food additives and other chemicals in our environment?
7. Who shall pay the cost of pollution control?
8. Can all chemical products and wastes be safely recycled?
9. Should the introduction of new chemical products be subject to government control in all cases, or only in drugs and food additives?
10. What are the hazards and benefits of birth control pills?

ADDITIONAL INNOVATIVE ACTIVITIES

1. School wide survey of home chemical use.
2. Neighbor safety check of dangerous chemical storage.
3. Individualized study program using learning activity packages.
4. Hydroponic gardening in school.
5. School brand of a consumer product-cosmetics, soap, and deodorant compounds.
6. Contact Environmental Protection Agency in Washington D. C. regarding pollution control and recycling products.
7. Construct molecular models.
8. School wide narcotic use survey.

REFERENCES

1. Black, Perry O. and Burke, William E. Practical Chemistry for Everyone. New York: Theo Audel and Co., 1964.

2. Brooks, W. O. Modern Physical Science. New York: Holt, Rinehart and Winston, 1968.

3. Chemical Bond Approach Project. Chemical Systems, St. Louis: McGraw Hill, 1968.

4. Chemical Education Material Study. Chemistry an Experimental Science. San Francisco: W. H. Freeman, 1963.

5. Choppin, Gregory R. and Jaffe, Bernard. Chemistry. Morristown, N. J.: Silver Burdett, 1965.

6. Eckert, Theodore et al. Discovery Problems in Chemistry. New York: College Entrance Book Company, 1969.

7. Educational Services Inc. Introductory Physical Science. New York: Prentice Hall, 1968.

8. Ford, Leonard A. Chemical Magic. Minneapolis: T. S. Denison Co., 1959.

9. Geffner, Saul L. Fundamental Concepts of Modern Chemistry. Atlanta: Amsco, 1966.

10. Greenstone, Arthur. Concepts in Chemistry, New York: Harcourt, Brace and World, 1966.

11. Hogg, John C. Physical Chemistry. New York: Van Nostram, 1966.

12. Mariella, Raymond. Chemistry of Life Processes. New York: Harcourt, Brace and World, 1968.

13. Metcalfe, H. C. et al. Modern Chemistry. New York: Holt, Rinehart and Winston, 1968.

14. O'Connor, Paul R. et al. Chemistry Experiments and Principles. New York: Raytheon, 1968.

15. Oxanhorn, Joseph M. Pathways in Science. New York: Globe, 1970.

16. Palder, Edward L. Magic with Chemistry. New York: Grosset and Dunlap, 1964.

MASTER SHEET - APPLIED CHEMISTRY I

Objective	Laboratory Experiments	Text References	General References	Films	Film Loops	Reports	Demonstrations	Speakers	Film Strips	Field Trips
1	1, 2, 3, 4, 5		6	15, 1	5, 6, 7, 10, 12		8		11	
2	12, 3, 4, 5		6	15, 16	13, 12, 6, 7, 8				11	
3	4, 22	1	6, 2	16	11	2				
4	1, 2, 3, 4, 5		6, 2	15, 16	12, 13		8		11	
5		1, 5, 6, 7	5, 2	1	3	3, 19	9, 13, 20, 21, 24		9, 16, 21	
6		1		3, 6, 12	2, 3, 4		24		22	
7	6, 8, 9, 12, 23	7, 1, 5, 6	15, 2, 6	1, 7, 12			1, 16, 8, 24			
8	8, 9, 14, 23	1, 5, 6, 7	5, 10, 2	4, 6, 7, 8		4, 9, 21	4, 5, 6, 10, 17	C-2	3, 9, 15	10
9		1, 5, 6, 7	5, 10						17, 20	
10		1, 5, 6, 7	10	9, 10, 4, 5, 8		4, 9, 14, 21	10, 13, 16, 17	C-2	15, 16, 17	
11	13, 19	1	6, 10, 2, 5, 12	9		12, 14, 16, 18	3, 18, 23	CP-2		6
12	7, 14, 15, 16, 25, 26	1, 5, 6, 7	6, 2, 10	9, 10	1	9, 3, 5, 6, 8, 14	3, 6, 10, 11, 18, 23		1, 18	
13	27, 26, 25, 16, 15, 7	1, 5, 6, 7	6, 2							
14	7, 14, 15, 26, 25, 26	1, 5, 6, 7	6, 2	9, 10	1		11		1, 18	
15	28, 29, 33, 34	1	6, 2	8, 14		4, 8, 9, 10	17, 26, 31			2, 5
16		1				10	28	M-1, 4		
17	16, 25, 26	1, 5, 6, 7	6, 2	6, 3, 10		15, 4, 8	22, 31		13, 18	1, 5
18		1	10	4, 14, 8		9, 10, 4, 21	28, 29, 33		15	
19	16, 11, 17, 18, 19, 20, 21, 28, 30, 33	1	4, 10, 18, 19, 20, 21	4, 11, 8, 14		4, 10, 9, 21	28, 29, 33		15	5
20	30	1	20, 21			11	16	M-2		
21	20	1	20, 21, 3	4, 11, 8, 14		4, 9	29			4

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

CHEMISTRY OF BIOLOGY

5314.15

SCIENCE
(Experimental)

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1971

CHEMISTRY OF BIOLOGY
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Written by Joe Adams and Sam Viviano
for the
DIVISION OF INSTRUCTION
Dade County Public Schools
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DADE COUNTY SCHOOL BOARD

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CHEMISTRY OF BIOLOGY

COURSE DESCRIPTION:

Topics to be explored include the nature of a model, the structure of matter, the heterotroph hypothesis, fundamental characteristics of a living thing, the chemistry of respiration, photosynthesis, digestion and the endocrine glands; the effects of detrimental chemicals on living systems and the chemistry of excretion.

ENROLLMENT GUIDELINES:

This course is designed as an introductory biochemistry course at the high school level. While the course is elective and no pre-requisite is required, the Scientific Mathematics quin taken concurrently or beforehand is strongly desirable to ensure greater success with the abstractions and concepts involved.

STATE ADOPTED TEXTS

1. Biological Science Curriculum Study. Biological Science: Molecules to Man. (Blue version) 2nd. ed. Boston: Houghton Mifflin Co., 1968.
2. Biological Science Curriculum Study. High School Biology: BSCS Green Version, 2nd. ed. Chicago: Rand McNally and Company, 1966.
3. Biological Science Curriculum Study. Biological Science: An Inquiry Into Life. (Yellow version) 2nd. ed. New York: Harcourt, Brace and World, Inc., 1968.

PERFORMANCE OBJECTIVES

1. Given examples of static and dynamic models, the student will construct molecular structural models.

2. The student will identify elements, compounds and mixtures.

3. The student will describe the properties of the fundamental particles.

4. Given a periodic table, the student will determine neutron number of the most common isotope from atomic number.

5. Given a nuclear equation, the student will predict radioactive emissions from radioisotopes.

6. The student will determine formulae by application of the octet rule.

7. The student will predict the solubility of certain covalent and ionic substances in water based on its property of polar covalence.

8. The student will deduce molecular types based on their:
   a. Relative positions in the periodic table. (Relative electronegativities)
   b. Proton donating or accepting capacity
   c. Capacity for polymerization. (by dehydration synthesis)

9. Given a formula, the student will differentiate among fats, carbohydrates, proteins, amino acids, nucleotides, purines and pyrimidines.

10. The students will integrate the various sequences of the heterotroph hypthesis into a composite whole.

11. The student will match enzyme with substrate, illustrating enzyme specificity.

12. Having assembled an apparatus for CO_2 and alcohol production by yeast, the student will use the apparatus to observe aerobic and anerobic respiration.

13. Having constructed a respirometer, the student will measure CO_2 production from the human breath by titration.

14. The student will use various indicators for the identification of food and food derivatives.

15. The student will contrast the effects of steroid and non-steroid hormones on the human body.

16. The student will discuss critically the effect of drugs, food additives and pollutants on the human body.

17. The student will generalize from data the effects of stimulants and depressants on the heart and circulation.

18. The student will propose tentative solutions to the critical conditions of our present environment.

COURSE OUTLINE

I. The Nature of a Model

A. Models of ships, cars, airplanes and rockets--nearly exact replicas on a small scale.

B. Atomic and molecular models--provide best representation available in a tangible form but do not convey dynamics of atomic and molecular motion.

II. Structure of Matter

A. Kinetic theory--all particles in constant motion except at Absolute zero.

B. So called "fundamental" particles are not presently reducible to smaller entities.
1. Discuss general properties of the fundamental particles.
2. Discuss their arrangement in atomic structure.
3. Discuss radioactivity.

C. Mass number, isotopes, atomic weight, atomic number.

D. Bonding--Octet rule--Formula writing.
1. Covalent and coordinate covalent.
2. Polar covalent.
3. Ionic.
4. Hydrogen.

E. Water structure.
1. Anomalous behavior--freezing density and temperature of maximum density--high relative boiling point to other compounds of similar molecular weight--significance of these properties.
2. "Universal solvent" action of water--on both covalent and ionic substances.

F. Molecular types
1. Acids and bases.
2. Other ionic compounds.
3. Molecular structures.
4. Polymers and polymolecular structures.
5. Biochemical compounds of the preceding types.

G. General formulae
   1. Fats
   2. Carbohydrates
   3. Proteins
   4. Amino acids
   5. Nucleotides
   6. Purines
   7. Pyrimidines

H. Important generalized reactions in biochemistry
   1. Hydrolysis--decomposition
   2. Dehydration synthesis--composition

III. Heterotroph Hypothesis

A. Conditions prevalent in the primitive atmosphere.

B. Experimental evidence of possible reaction sequences:
   1. Miller
   2. Fox (Point out dehydration synthesis)
   3. Coacervate formation.

C. Virus--living or non-living?
   1. Metabolism apparently lacking.
   2. Capacity for reproduction, but only in living tissues.

D. Catalysts, enzymes, coenzymes, and vitamins

E. The need for an energy carrier--ATP

F. The need for a reproductive molecule--DNA

G. The need for a protein synthesizer--RNA

IV. Fundamental Characteristics of a Living Thing.

A. Ability to metabolize.

B. Ability to reproduce.

V. The Chemistry of Respiration.

A. Aerobic
   1. The hydrogen transport mechanism.
   2. The citric acid cycle.

B. Anerobic
   1. Fermentation
   2. Glycolysis

VI. The Chemistry of Photosynthesis.

A. Role of grana in the chloroplasts

B. Factors required for photosynthesis
   1. Light
   2. Chlorophyll
   3. Carbon dioxide
   4. Water

C. Light and dark reactions
   1. Photolysis
   2. CO_2 fixation

D. Compare photosynthesis with aerobic respiration

VII. The Chemistry of Digestion.

A. Specific enzyme activity

B. Influence of accessory substances--bile, HCL, etc.

VIII. The Chemistry of the Endocrine Glands.

A. Steroid hormones--Cortisone, etc.

B. Non-steroid hormones--Insulin, etc.

IX. The Chemistry of Excretion.

X. The Effects of Detrimental Chemicals on Living Systems.

A. Drugs--Thalidomide, heroin, lysergic acid diethylamide, etc.

B. Food additives--Cyclamates, monosodium glutamate, etc.

C. Environmental pollutants--Mercury salts, smog, etc.

EXPERIMENTS

Biological Science Curriculum Study. Biological Science: Molecules to Man. 2nd. ed. Boston: Houghton Mifflin Co., 1968.

1. Acids, Bases and pH (pp. 120-122)
2. Investigation of the Formation of Coacervates (pp. 132-133)
3. Investigating the Work of a Simple Catalyst (pp. 143-144)
4. Investigating Digestion (pp. 519-520)
5. Investigating Fermentation (pp. 150-151)
6. Investigating Rates of Oxygen Consumption (pp. 502-504)
7. Investigating Chlorophyll Pigments (pp. 187-188)
8. Investigating Variations in the Heartbeat Rate of DAPHNIA (pp. 770-771)

Metcalfe, Williams and Castka. Exercises and Experiments in Chemistry. (Laboratory Manual) New York: Holt, Rinehart and Winston, Inc. 1966.

9. Mixtures and Compounds (p. 129)
10. Physical and Chemical Changes (p. 131)
11. Oxygen: Catalysis (optional)(P. 133)
12. Balancing Chemical Equations (p. 143)
13. Types of Chemical Reactions (p. 149)
14. Chemical Properties of Water (p. 161)
15. Solubility, Rate of Solution,Heat of Solution (p. 175)
16. Preparation and Properties of Acids (p. 185)
17. Preparation and Properties of Hydroxides (p. 189)
18. Hydronium Ion Concentration. pH (p. 193)
19. Relative Strength of Acids and Bases (p. 199)
20. Titration of an Acid and a Hydroxide (p. 201)

DEMONSTRATIONS

Biological Science Curriculum Study. Biological Science: Molecules to Man. 2nd. ed. Boston: Houghton Mifflin Company, 1968.

1. 5-4 Electrolysis of Water (pp. 115-116)
2. S - 15 Investigating Digestion of Fat (p. 772)
3. S - 16 Investigating the Accumulation of Phosphate in an Animal (p. 773)
4. S - 17 Investigating the Effect of ATP of Contractile Proteins (p. 774)
5. 13-20 Investigating the Actions of Hormones on Frog Reproduction (pp. 327-331)

REPORTS

1. The effects of the natural or synthetic opiates or hallucinogenic drugs which are found throughout the United States.
2. One of the methods used to treat any one of the environmental pollutants present today. Explore the advantages as well as the disadvantages of the method of treatment. Speculate as to the effects of the pollutants if they went unchecked. Give examples already present.
3. The shielding qualities of ozone in the outer atmosphere in terms of solar radiation. Research the topic of solar radiation being a cause of certain types of skin cancer.
4. A chemical environmental limiter such as the environment of a bacteria or fungi being too acidic or alkaline. Discuss optimum pH as related to growth rate or other measurable metabolic processes.
5. Synthetic food additives such as preservatives or flavorings. Be specific as to the effects of these synthetics on the human consumer.
6. The steps of photosynthesis with detailed information on specific pigments involved. Direct your efforts to the area of the oxygen-carbon dioxide cycle on earth and where the majority of breathable air originates.

RELATED PROBLEMS

1. Give the students a list of chemical substances and have them calculate molecular mass.
2. Assign some problems in weights of compounds and determine the number of moles, or parts of moles.
3. Calculate the amount of water lost by a plant through transpiration.
4. Identify proteins, amino acids, carbohydrates, vitamins, fats, fatty acids and glycerol.
5. Assign a project on the effect of various drugs on insects or rodents in the laboratory.
6. Figure the pH of the various lakes, ponds and canals in the county area.
7. Assign a problem in water analysis.

RESOURCE LIST TEXTS

1. Biological Science Curriculum Study. Biological Science: Molecules to Man. (blue version) 2nd. ed. Boston: Houghton Mifflin Company, 1968.
2. Biological Science Curriculum Study. High School Biology: BSCS Green Version. Chicago: Rand McNally and Company, 1966.
3. Biological Science Curriculum Study. Biological Science: an Inquiry into Life. (yellow version) 2nd. ed. New York: Harcourt, Brace and World, Inc., 1968.
4. Biological Science Curriculum Study. Biological Science: Interaction of Experiments and Ideas. 2nd. ed. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970.
5. Weisz, Paul B. The Science of Biology. New York: McGraw-Hill Book Company, Inc., 1963.

READING LIST

1. "Enzymes" -- Pfeiffer, John E., Scientific American, Sept. 1957.
2. "ATP" -- Stumpf, Paul K., Scientific American, April, 1953.
3. Great Experiments in Biology -- M. Gabriel and S. Fogel, including, "On the Production of Oxygen", Englemann, T. W., Englewood Cliffs, N. J., Prentice Hall Inc., 1955.

SPECIAL EQUIPMENT

1. Atomic models - 2 sets
2. Electrolysis apparatus - 1
3. Clinitest tablets - 5 bottles
4. Acetest paper - 5 rolls
5. Hydrometers - 12

PLACES TO VISIT

1. Baptist Hospital clinical laboratories
2. Dade Reagents
3. Jackson Memorial Hospital
4. V. A. Hospital
5. University of Miami Medical School

DADE COUNTY 16mm FILMS

1. Atom in Biological Science (EBEC film)
   AV# 1-03550
2. Carbon and Its Compounds (Coronet)
   AV# 1-01968
3. Catalysis (Sutherland) (No. 4127)
   AV# 1-10809
4. Chemical Families (No. 4112)
   AV# 1-10819
5. Chemical Reactions (Ed. Pic. Sys.)
   AV# 1-12975
6. Properties of Acids, Bases and Salts
   AV# 1-30347
7. Colloidal State (Coronet)
   AV# 1-10933
8. Standard Solutions and Titration
   AV# 1-10926

TRANSPARENCY

1. DNA (Ward's N.S.E.)
   AV# 2-30083

FILM STRIPS

1. DNA - A Key to All Life - Life Film Strip
2. Macromolecules in Biology - PSP McGraw-Hill --- 1-558
3. Chemical Laboratory in Your Body - PSP McGraw-Hill--171723
4. Cell Chemistry - DNA and RNA, Evidence of Structure and Function - Wards - 70-W-33006

FILM LOOPS

1. Chromatography and Chlorophyll
   Ealing Film Loops -- 81-5894
2. Measuring the Rate of Photosynthesis
   Ealing Film Loops -- 81-563

MASTER SHEET - CHEMISTRY OF BIOLOGY

Objectives	Experiments	Student Text Reference	Additional Text Reference	Films	Film Loops	Reports	Demonstrations	Speakers	Slides or Film Strips	Field Trips
1	1	1 pp.109-120	5 pp.18-26							
2	9	1 pp.125-127	2 pp.11-12	1						
3		1 pp.125-132	2 pp.1-20 5 pp.25-31	2			1			2
4	13	1 pp.117-118	2 p.11 5 p.19	4						
5	12	1 pp.108-145	5 p.345	5		3	3			
6	14	1 pp.108-145	5 pp.41-42 3 pp.90-91							
7	15-17	1 pp.154-159	2 pp.386-388 3 pp.112-113 341-342 5 pp.78-82	6		4				
8	18-19	1 pp.119-125	4 pp.22-25 5 p.28	3, 7						
9	1, 3	1 pp.125-161 215-243	2 pp.395-299 3 pp.80-103 4 pp.208-212 5 pp.71-74						1,2,4	1
10	2	1 pp.87-160	3 pp.177-197 5 pp.39-64							
11	4	1 pp.142-149 1 pp.252-253 1 pp.523-527	2 pp.389-397 3 pp.104-109 396-399 5 pp.31-33							
12	5	1 pp.149-153 196-197	3 pp.226-228 4 pp.37-40 47-48 5 pp.62,407						3	3
13	6-20	1 pp.500-517	3 pp.419-437 4 pp.49-55 5 pp.395-421	8		6				
14	4	1 pp.518-543	2 pp.455-459 3 pp.388-403 5 pp.355-381			5	6			4
15		1 pp.562-579	2 pp.479-481 3 pp.452-457 4 pp.226-236				5			
16		1 pp.82-83	4 pp.338-349			2				5
17	8	1 pp.574				1	4			

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Science: MATTER AND ITS CHANGES 5311.06
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MATTER AND ITS CHANGES

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SCIENCE

(Experimental)

Written by Ronald J. Matzuga

for the

DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida
1971

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MATTER AND ITS CHANGES

COURSE DESCRIPTION

This is a survey course which will introduce the student to the classification, properties, and the changes of matter. The course is laboratory orientated.

ENROLLMENT GUIDELINES

None, however, a student without previous knowledge of scientific measurement should complete in depth assignments and extra laboratory experiences to achieve the first Performance Objective.

STATE ADOPTED TEXTS

Abraham, Norman, et al. Interaction of Matter & Energy. Chicago: Rand McNally & Company, 1968.

Brandwein, Paul F., et al. Concepts in Science 3. New York: Harcourt, Brace & World, Inc., 1966.

Brandwein, Paul F. et al. Concepts in Science 4. New York: Harcourt, Brace & World, Inc., 1966.

Brandwein, Paul F. et al. Concepts in Science 6. New York: Harcourt, Brace & World, Inc., 1966.

Choppin, Gregory, and Jaffe, Bernard. Chemistry: Science of Matter, Energy, and Change. Morristown: Silver Burdett Company, 1965.

Dolmatz, Malvin S., and Wong, Harry K. Ideas and Investigations in Science: Physical Science. Englewood Cliffs: Prentice-Hall, Inc., 1971.

Fisk, Franklin G. and Blecha, Milo K. The Physical Sciences: Investigating Man's Environment. River Forest: Laidlaw Brothers, 1971.

STATE ADOPTED TEXTS (CONT'D)

Greenstone, Arthur W., et al. Concepts in Chemistry. New York: Harcourt, Brace & World, Inc., 1966.

IPS Group of Educational Services Incorporated. Introductory Physical Science. Englewood Cliffs: Prentice-Hall, Inc., 1967.

Metcalfe, H. Clark, et al. Modern Chemistry. New York: Holt, Rinehart and Winston, Inc., 1966.

Oxenhorn, Joseph M., and Idelson, Michael N. Pathways In Science, Chemistry 1: The Materials of Nature. New York: Globe Book Company, Inc., 1968.

Smith, Herbert A., et al. Science 6. River Forest: Laidlaw Brothers, 1966.

Thurber, Walter A., and Kilburn, Robert E. Exploring Physical Science. Boston: Allyn and Bacon, Inc., 1968.

Tracy, George R., et al. Modern Physical Science. New York: Holt, Rinehart and Winston, Inc., 1970.

PERFORMANCE OBJECTIVES

The student will:

1. Manipulate various instruments using the appropriate units of measurements as prescribed by the various laboratory experiments he undertakes.

2. Manipulate various scientific instruments in determining the definition of matter.

3. Given a chemical symbol for an element, construct a model of its atomic structure.

4. After having read the assignments from the text, define atoms, molecules and elements.

5. State the atomic theory.

6. With the essential data, determine the atomic weights and numbers of the elements.

7. Given any of the phases of matter, differentiate the molecular behavior that exists between each.

8. Through laboratory experiences, differentiate between a physical and chemical change.

9. Construct a list identifying matter by its general and specific properties.

10. Given an experiment to plan, plot a graph demonstrating the activity level of four to eight common metals when subjected to a chemical change.

11. Given an experiment or chemical formula, cite evidence to support the conservation of mass.

12. Given samples, distinguish the differences which exist among solutions, mixtures, and suspensions.

PERFORMANCE OBJECTIVES (CONT'D)

13. Write chemical equations to determine chemical reactions.

14. Classify given solutions based upon electrical conductivity.

15. Given a solution, identify it as acid, base, or neutral.

16. Assemble the correct apparatus for the neutralization of an acid or a basic solution.

COURSE OUTLINE

I. Scientific Measurements
   A. Linear
   B. Volumetric
   C. Weight (mass)
   D. Temperature
   E. Graphs
II. Matter
III. Structure of Matter
   A. Atoms
   B. Elements
   C. Molecules
IV. Atomic Theory
   A. Definition

COURSE OUTLINE (CONT'D)

B. Atomic weight

C. Atomic number

V. Conservation of Mass

A. Definition

B. Application

VI. States (phases) of Matter

A. Solid

B. Liquid

C. Gas

VII. Changes in Matter

A. Physical

B. Chemical

VIII. Properties of Matter

A. General

B. Specific

IX. Classification of Matter

A. Substances
   1. Elements
   2. Compounds
   3. Mixtures

B. Solutions

C. Suspensions

COURSE OUTLINE (CONT'D)

X. Chemical Calculations

A. Formulas

B. Equations

XI. Chemical Reactions

A. Decomposition

B. Synthesis (composition)

C. Replacements

XII. Acids, Bases and Salts

EXPERIMENTS AND DEMONSTRATIONS

Abraham, Norman, et al. Interaction of Matter & Energy. Chicago: Rand McNally & Company, 1968.

1. Measurement of Length and Area (Inv. 16, p. 117)
2. Determining the Volume of Solids (Inv. 17, p. 118)
3. Mass and Volume of Water (Inv. 18, p. 123)
4. Mass and Volume of Liquids Other Than Water (Inv. 19, p. 125)
5. Separating Components of Matter (Inv. 4, p. 40)
6. Observing Effects of Electrical Charges (Inv. 5, p. 46)
7. Charged Particles In Solution (Inv. 6, p. 60)
8. Conductivity of Solutions (Inv. 7, p. 84)
9. Testing For Acids and Bases (Inv. 8, p. 89)
10. Precipitation Reactions (Inv. 9, p. 92)
11. Concepts of Analysis (Inv. 10, p. 97)
12. Gaining Additional Evidence (Inv. 11, p. 100)
13. Problem of Color (Inv. 12, p. 103)
14. Role of Energy (Inv. 13, p. 105)
15. Calibrating a Thermometer (Inv. 34, p. 191)

EXPERIMENTS AND DEMONSTRATIONS (CONT'D)

16. Water and Ice (Inv. 35, p. 200)
17. Ice, Salt, Sugar and Alcohol (Inv. 36, p. 201)
18. Behavior of Matter Under Condition of Low Temperature (Optional) (Inv. 37, p. 203)

Brandwein, Paul F. et al. The World of Matter-Energy. New York: Harcourt, Brace & World, Inc., 1964.

19. Investigating A Molecule (Ex. 1, p. 3)
20. Recognizing the Changes (Ex. 1, p. 16)
21. Kinds of Solutions (p. 21)
22. Making a Solution (p. 21)
23. Strength of Solutions (p. 22)
24. Saturated Solutions (Inv. p. 23)
25. Decomposition Reactions (p. 26)
26. Decomposition Reactions (p. 26)

Brandwein, Paul F., et al. Concepts in Science 3 New York: Harcourt, Brace & World, Inc., 1966.

27. What Happens to Perfume (Inv. p. 118.)
28. What Happens to Mothballs (Inv. p. 120)

Brandwein, Paul F., et al. Concepts in Science 4. New York: Harcourt, Brace & World, Inc., 1966.

29. An Investigation into Oxygen and Air (p. 104)

Brandwein, Paul F., et al. Concepts in Science 6. New York: Harcourt, Brace & World, Inc., 1966.

30. An Investigation into Models of Atoms (p. 289)
31. Making Models: The Atoms (p. 293)

Davis, Ira C., et al. Science 1: Observation and Experiment. New York: Holt, Rinehart and Winston, 1969.

32. Student Activity, Measurement, Linear (p. 9)
33. Student Activity, Measurement, Linear, (p. 11)
34. Student Activity, Measurement, Volume (p. 14)
35. Student Activity, Measurement, Temperature (p. 15)

EXPERIMENTS AND DEMONSTRATIONS (CONT'D)

Davis, Ira C., et al. Science 2: Experiment and Discovery. New York: Holt, Rinehart and Winston, 1969.

36. Which is heavier, water or an equal volume of motor oil? (Dem.,p. 9)
37. What are some properties of liquids? (Dem.,p.23)
38. What determines the volume and shape of a gas? (Dem., p. 25)
39. What happens when ice, a solid, is heated? (Dem., p. 27)
40. What is a mixture? (Dem., p. 31)
41. How can coal tar be produced? (Dem., p. 35)

Davis, Ira C., et al. Science: Discovery and Progress. New York: Holt, Rinehart and Winston, 1969.

42. Make these comparisons (Student Activity, p. 12)
43. What are some of the chemical properties of the elements? (Dem., p. 211)
44. What is an acid like? (Dem., p. 219)
45. What is the chemical reaction between metal and acid? (Dem., p. 220)
47. What are the properties of bases? (Dem., p.221)
48. How is a salt purified? (Dem., p. 224)
49. How is a salt produced? (Dem., p. 225)
50. What is baking powder? (Dem., p. 226)
51. What is the reaction of quicklime with water? (Dem., p. 227)
52. How is soap made? (Dem., p. 227)

Dolmatz, Malvin S., and Wong, Harry K. Physical Science: Ideas and Investigations In Science, Teachers Manual. Englewood Cliffs: Prentice-Hall, Inc., 1971.

53. To establish the need for standard units (Idea 1, Inv. 6, p. 36)
54. Reinforce the idea of standards by introducing the metric system (Idea 1, Inv. 7, p. 39)
55. Show how tables organize data. (Idea 1, Inv. 8, p. 42)
56. Show how graphs are used to present data quickly and clearly. (Idea 1, Inv. 9, p. 45)
57. Develop the concept that matter is everything that has weight and volume. (Idea 2, Inv. 1, p. 57)

EXPERIMENTS AND DEMONSTRATIONS (CONT'D)

58. Develop the concept of density as the measure of the compactness of matter (Idea 2, Inv. 2, p. 59)
59. Show that the mass of a given specimen of matter doesn't vary as it changes form. (Idea 2, Inv. 3, p. 62)
60. Introduce the notion that matter is made of particles. (Idea 2, Inv. 6, p. 68)
61. Show that the concept of constant proportions applies to decomposing materials as well as to combining them. (Idea 2, Inv. 8, p. 73)
62. Show the need for accurate observations in understanding common events. (Idea 1, Inv. 1, p. 25)
63. Introduce the idea that substances react in constant proportions. (Idea 2, Inv. 7, p. 70)
64. Reinforce the idea that the quantity of matter remains constant when its form changes. (Idea 2, Inv. 4, p. 64)
65. Extend the idea of the constant amount of matter to the case of chemical change (Idea 2, Inv. 5, p. 66)

Fisk, Franklin G. and Blecha, Milo K. The Physical Sciences: Investigating Man's Environment. River Forest: Laidlaw Brothers, 1961.

66. Make a List, Compounds. (Do It Yourself, p. 81)
67. Find Out By Trying, Electrons (p. 96)
68. Find Out by Trying, Atoms & Molecules (p. 101)

Greenstone, Arthur W., et al. Concepts In Chemistry. New York: Harcourt, Brace & World, Inc., 1966.

69. Decomposition by Electrolysis (p. 60)
70. Decomposition by Heat (p. 61)
71. Multiple Proportions (p. 66)
72. Relative Activity of Elements (p. 56)
73. Changes In Matter (p. 18)
74. Limit of Solubility (p. 183)
75. Supersaturation (p. 185)
76. Electrical Properties of Aqueous Solutions (p. 201)

77. Activity Series (p. 296)
78. Metals Less Active Than Hydrogen (p. 297)
79. The Nature of Colloids (p. 311)
80. The Tyndazl Effect (p. 313)
81. Emulsifying Agents (p. 317)

IPS Group of Educational Services Incorporated. Introductory Physical Science. New Jersey: Prentice-Hall, Inc., 1967.

82. Measuring Volume by Displacement of Water (Ex. 212, p. 9)
83. The Equal-arm Balance (Ex. 2.5, p. 12)
84. The Precision of the Balance (Ex. 2.6, p. 13)
85. Beads and Grams (Ex. 2.7, p. 14)
86. The Mass of Dissolved Salts (Ex. 2.8, p. 15)
87. Decomposition of Sodium Chlorate (Ex. 6.1, p. 101)
88. Decomposition of Water (Ex. 6.2, p. 104)
89. The Snythesis of Water (Ex. 6.3, p. 105)
90. Synthesis of Zinc Chloride (Ex. 6.4, p. 106)
91. A Reaction with Copper (Ex. 6.6, p. 110)
92. Reduction of Copper Oxide (Ex. 6.7, p. 111)
93. Flame Tests of Some Elements (Ex. 6.10, p. 116)
94. Spectra of Some Elements (Ex. 6.11, p. 117)

Matzuga, Ronald J. SILOS: Self Instructional Laboratory Orientated Science Program, Student Work Text, Unit 1-Matter. Fort Lauderdale: Matzuga, 1970.

95. What Is Matter (Ex. 1)

Oxenhorn, Joseph M., and Idelson, Michael N. Pathways In Science, Chemistry 1: The Materials of Nature. New York: Globe Book Company, Inc., 1968.

96. What Is Its Shape? (Ex., p. 10)
97. Can The Volume of A Liquid Change (Ex., p. 16)
98. What Is The Shape Of Water? (Ex., p. 17)
99. Watching A Kettle Boil (Ex., p. 20)
100. Does A Gas Have Weight? (Ex., p. 21)
101. Squeezed Air (Ex., p. 23)
102. Do All Metals Conduct Electricity? (Ex., p. 44)
103. A Mixture or A Compound? (Ex., p. 61)
104. Changing A Mixture To A Compound (Ex. p. 62)
105. Does The Weight Change (Ex., p. 83)
106. Rusting and Heat (Ex., p. 117)
107. Some Chemical Reactions Need Heat (Ex., p. 117)

EXPERIMENTS AND DEMONSTRATIONS (CONT'D)

108. Filtering Out The Sand (Ex., p. 123)
109. Getting The Salt Back (Ex., p. 123)
110. The Replacement Test (Ex., p. 129)
111. Another Endothermic Reaction (Ex., p. 119)

Smith, Herbert A., et al. Science 6. River Forest: Laidlaw Brothers, 1966.
112. Components of Molecules (Ex., p. 200)
113. Combining Elements (Ex., Try This, p. 205)

Thurber, Walter A., and Kilburn, Robert E. Exploring Science Eight. Boston: Allyn and Bacon, Inc., 1965.
114. A Conductivity Tester (Ex., p. 126)
115. Conductivity of Liquids (Ex., p. 127)
116. Electroplating (Ex., p. 128)
117. Making "Milk of Magnesia" (Ex.,p. 129)
118. Electro-refining (Ex., p. 131)
119. Testing Electric Cells (Ex., p. 133)
120. Ions In Electric Cells (Ex., p. 134)
121. Storage Cells (Ex., p. 135)
122. Forming Metal Ions With Acid (Ex., p. 138)
123. Reacting Metals With Metal Ions (Ex., p. 138)
124. Combining Elements (Ex., p. 139

Friedl, Alfred E. and Kitko, Frank W. Exercises and Investigations: Modern Physical Science, Teachers Edition. New York: Holt, Rinehart and Winston, Inc. 1970.
125. Measurement (Inv., 1-1, p. 5)
126. Mixtures and Compounds (Inv. 2-1, p. 11)
127. Properties of Acids (Inv., 5-1, p. 29)
128. Behavior of Bases (Inv., 5-2, p. 31)

Weisbruch, Fred T., et al. Patterns & Processes of Science: Laboratory Text No. 1 Lexington: Raytheon Education Company, 1969.
129. What Do You See (Ex. 1, p. 2)
130. Observation of a Sunset (Ex. 2, p. 4)
131. Observing Outdoors, Field Investigation No. 1 (Ex. 3, p. 5)

EXPERIMENTS AND DEMONSTRATIONS (CONT'D)

132. How Much? (Ex. 4, p. 7)
133. Which is Which? No. 1 (Ex. 5, p. 8)
134. Measurement (Ex. 6, p. 10)
135. To Observe ... (Ex. 7, p. 24)
136. Part II Measuring Volumes of Liquids (Ex. 6, p. 12)
137. How to Put Things in Their Places (Ex. 17, p. 119)
138. Properties (Ex. 18, p. 122)
139. The Case of Twin Beakers (Ex. 8, p. 50)
140. How Much Space? (Ex. 9, p. 59)
141. How Many Cubes? (Ex. 10, p. 62)
142. Discovering More About Matter (Ex. 11, p. 71)
143. Which is Which? No. 2 (Ex. 12, p. 80)
144. Scales (Ex. 13, p. 82)
145. Part IV, Time and Rate (Ex. 6, p. 17)
146. Which is Which? No. 3 (Ex. 15, p. 91)
147. Properties vs. Groups (Ex. 16, p. 113)
148. Part III. Mass (Ex. 6, p. 16)
149. Properties vs Phases (Ex. 19, p. 140)
150. Measurement of Temperature (Ex. 20, p. 146)
151. Temperature vs Change of Phase (Ex. 21, p. 154)
152. Volume (Ex. 22, p. 160)
153. Melting vs Freezing (Ex. 23, p. 163)
154. Evaporation 1 (Ex. 24, p. 166)
155. Evaporation 2 (Ex. 25, p. 170)
156. Freezing Water (Ex. 26, p. 173)
157. Field Investigation No. 2 (Ex. 27, p. 175)
158. Distillation (Ex. 28, p. 177)
159. Which is Which? No. 4 (Ex. 30, p. 214)
160. More Properties (Ex. 31, p. 218)
161. Analytical Testing (Ex. 32, p. 222)
162. Acids vs Bases (Ex. 35, p. 229) Part 1
163. Acids vs Bases (Ex. 35, p. 231) Part 2
164. Acids vs Bases (Ex. 35, p. 232) Part 3
165. Mass vs Temperature (Ex. 29, p. 203)
166. Catalzying Reactions (Ex. 34, p. 227)
167. The Unknown (Ex. 33, p. 226)

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168. "Caldron Bubble" (Ex. 25, p. 141)
169. Metals on the Move (Ex. 26, p. 144)

EXPERIMENTS AND DEMONSTRATIONS (CONT'D)

170. Action (Ex. 27, p. 146)
171. Ions on the Move (Ex. 28, p. 148)
172. Meter Maker (Ex. 29, p. 153)
173. Conductivity (Ex. 30, p. 159)

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174. The Snellen Ratio (Ex. 8, p. 104)
175. Ratio and Proportion in the Physical World (Ex. 9, p. 110)
176. Indirect Measurement-Triangulation (Ex. 10, p. 119
177. Chemical Changes Form New Molecules (Ex. 31, p. 363)
178. Heat Energy Liberated in a Chemical Reaction (Ex. 32, p. 375)
179. The Law of Constant Chemical Composition (Ex. 33, p. 379)
180. The Law of Conservation of Mass (Ex. 34, p. 384)
181. Mass Relations in a Chemical Reaction (Ex. 35, p. 390)
182. Mass Relations in Solution: Amount of Vitamin C in Lemon Juice (Ex. 36, p. 396)

RELATED PROBLEMS

1. Changing milliliters to liters and millimeters to meters by moving the decimal point 3 places to the left.

2. Volume problems using various units in 3 dimension.

3. Volume problems for irregular shaped objects by the displacement of a liquid (water).

4. Changing Fahrenheit to Centigrade (Celsius) and Centigrade to Fahrenheit degrees.

5. Balancing Equations:
What is the balanced equation for the combining of hydrogen and oxygen?

6. Formulas:
Write the formula for the combining of sodium and chlorine.

7. Write the formula for the combining of aluminum and a sulfate radical.

8. Ratio: Determine the ratio of 48 and 12.

9. What is the weight ratio of hydrogen to oxygen in the compound water?

10. What is the volume ratio of hydrogen to oxygen in the electrolysis of water?

11. If 100 liters of hydrogen is produced in the decomposition of water, what is the amount of oxygen produced?

12. Replacement reaction (typical)

13. Composition reaction or synthesis (typical)

14. Decomposition reaction (typical)

DADE COUNTY 16mm FILMS

1. Acid-Base Indicators (No. 4130)
   AV#1-10799, 19',C.

2. Acids, Bases and Salts
   AV#1-10947, 21', C.

3. Chemical Change
   AV#1-10910, 12', C

4. Chemical Changes All About Us
   AV#1-10914, 13', BW

5. Chemical Reactions
   AV#1-12975, 18', BW

6. Colloidal State
   AV#1-10933, 16', C

7. Colloids
   AV#1-01958, 11', BW

8. Determination of Atomic Weights
   AV#1-10925, 19', C

9. Explaining Matter: Atoms and Molecules
   AV#1-10777, 13', C

10. Explaining Matter: Molecules In Motion
    AV#1-10920, 11', C

11. Introduction To Chemistry
    AV#1-01930, 10', BW

12. Law of Conservation of Energy and Matter
    AV#1-01753, 8', C

13. Molecular Theory of Matter
    AV#1-01945, 11', BW

14. Physical and Chemical Change
    AV#1-31341, 28', BW

FILMS (CONT'D)

15. Preface To Chemistry
AV#1-10888, 16', BW

16. Properties of Acids, Bases and Salts
AV#1-30347, 28', C

17. Properties of Solutions
AV#1-30345, 28', BW

18. Simple Changes In Matter
AV#1-01935, 10', BW

19. Solids, Liquids, and Gases
AV#1-01739, 10', BW

20. Solutions
AV#1-10928, 16', C

21. Standard Solutions and Titrations
AV#1-10926, 21', BW

22. Using The Laboratory
AV#1-01342, 11', C

23. What Are Things Made Of?
AV#1-01954, 11', C

24. World of Molecules, The
AV#1-01950, 11', C

25. "A" Is For Atom
AV#1-10790, 16', C

26. Our Friend The Atom (Part 1)
AV#1-30333, 50', C

27. Our Friend The Atom (Part 2)
AV#1-30335, 50', C

28. Adventures In Science: The Size of Things
AV#1-01743, 11', C

FILMS (CONT'D)

29. Electrochemical Reactions
AV#1-10929, 11', BW

30. Electrochemistry
AV#1-01961, 11', BW

31. Elements, Compounds and Mixtures (0111)
AV#1-30227, 25', C

32. Matter and Energy
AV#1-01731, 10', BW

33. Measuring Temperature
AV#1-01745, 10', BW

34. Properties of Gases
AV#1-01832, 10', BW

35. Properties of Liquids
AV#1-01801, 10', BW

36. States of Matter
AV#1-01949, 10', BW

37. Surface Tension
AV#1-10715, 13', BW

38. Understanding The Physical World Through Measurement
AV#1-31184, 33', C

39. Wonders of Chemistry
AV#1-01933, 10', BW

FILM STRIPS

1. What Things Are Made Of, 427-20, SVE. 43 frames.
2. Chemical Changes, 427-21. SVE, 42 frames.
3. Atoms and Molecules, 427-22. SVE, 46 frames.
4. Experiments with Length, 449-1. SVE, 41 frames.
5. Experiments with Mass, 449-2. SVE, 34 frames.
6. Experiments with Volume and Density, 449-3. SVE, 49 frames.
7. Elements, Compounds, Mixtures, 499-2, SVE, 53 frames.
8. Symbols, Formulas, Equations, 493-3, SVE, 50 frames.
9. Atomic and Molecular Weights, 493-4. SVE, 51 frames.
10. Solutions, Suspensions, and Colloids, 493-6. SVE, 52 frames.
11. Acids, Bases, and Salts, 493-7. SVE, 58 frames.

TRANSPARENCIES

1. Accurate Measurement of Weight
   AV#2600027, BW

2. Atomic Structure
   AV#2-00163, BW

3. Atomic Structure
   AV#2-00085, BW

4. Chemistry Laboratory Techniques
   AV#2-00164, BW

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MASTER SHEET - MATTER AND ITS CHANGES

Objectives	Laboratory Experiments	Student Text	Supplementary References	Related Problems	Films	Film Strips	Transparencies
1	1, 2, 3, 4, 32, 33, 34, 35, 36, 42, 53, 54, 55, 56, 62, 82, 83, 84, 85, 86, 125, 129, 130, 131, 132, 133, 134, 136, 140, 141, 142, 145, 174, 175, 176, 148	1 pp.109-134 8 pp.8-16 9 pp.4-13 10 pp.9-13 11 pp.3-34 24 pp.1-10 16 pp.6-28	7A pp.II, p.696 13 pp.48-59 17 Unit 11&12 22 pp.476-478 25 pp.1-45,55 27 pp.99-125	1, 2, 3, 4, 5, 8, 9	11, 15, 22, 28, 33, 38, 39	4, 5, 6	1, 4
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